How Apps are Used by and with Individuals with Autism Spectrum Disorder:
A Scoping Study with Stakeholder Consultation

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ABSTRACT

The number of smartphone- and tablet-applications, or apps*, for health and wellbeing continues to grow at a rapid pace. This scoping study identified articles reporting on the use of apps by and with individuals with autism. Professionals and parents of children with autism also completed a questionnaire as part of stakeholder consultation. Of the 40 studies identified, 28 reported on the use of apps specifically designed for autism, with clearly the most frequently being the communication support app* Proloquo2Go*. Other uses include assistance in the teaching and maintenance of social and life skills as well as faciliation in the delivery of behavioral interventions. Stakeholders confirmed the importance of apps to assist communication. While empirical data are available on the effectiveness of apps for augmentative and alternative communication, areas for further research include the functionality and effectiveness of apps for delivery of behavioral interventions and educational games for individuals with autism.*

KEYWORDS

Apps, Autism, Scoping Study, Smartphone, Stakeholder Consultation, Tablet

INTRODUCTION

Emerging technologies are developing the potential for services to go beyond the clinic, and to be extended to outpatient settings (Clough & Casey, 2015; Gravenhorst et al., 2015; Yan, Chen, & Yu, 2014) and delivering a variety of contingent forms of assistance "on site" in "real time" (Auer & Griffiths, 2014; Gainsbury & Blaszczynski, 2011), for people with a variety of mental health problems (Campbell, Caine, Connelly, Doub, & Bragg, 2015; Griffiths, 2010). The present paper considers the potential for technologies to assist those with autistic spectrum disorder (ASD).

Innovative technology frequently plays an important role in interventions for ASD (Grynszpan, Weiss, Perez-Diaz, & Gal, 2014). Some of the latest technological advances include the features provided by smartphone- and tablet-applications, or *apps*. Because of its ease of use and broad accessibility, this technology has the potential to revolutionize how behavioral support is provided to individuals with ASD, and a review of the literature on the way in which these apps have been used so far in this field is thus timely. Outlining the purposes for which apps have started to be used will be helpful to guide further development, especially by identifying areas of untapped opportunities.

Recent technological advances have dramatically influenced the way in which people organize their lives and interact with each other (Godine & Barnett, 2013). Apart from being a telephone, so-called smartphones provide multiple functions, such as taking photos, playing games, providing ubiquitous access to the Internet, being a global positioning device, and many of the features previously fulfilled by personal digital assistants (Ozdalga, Ozdalga, & Ahuja, 2012). Smartphones and tablet devices share the same kinds of operating systems that run pre-installed or downloadable software applications referred to as *apps*. At the beginning of 2014, the Apple App Store offered more than one million apps for its devices within the *iPhone*, *iPad* and *iPod touch* range, and sales for 2013 exceeded 10 billion USD (Apple, 2014). While Apple was the top smartphone manufacturer in 2013, the most commonly used smartphone platform was Google Android (Comscore, 2014), with also more than one million apps available for download to various Android smartphone and tablet models (Appbrain, 2014).

At the end of 2013, more than 156 million people owned a smartphone in the United States alone, representing 65.2 percent of the country's mobile phone market (Comscore, 2014). The most popular tablet device is the *iPad*, with estimated sales figures of more than 170 million since 2010, while its main competitor, the *Samsung Galaxy* tablet, could boast sales of 40 million within 2013 alone (Trustedreviews, 2014). With such market penetration, smartphones and tablets have naturally become a major communication device in the health sector. More and more physicians use smartphones (Ozdalga et al., 2012), which is not only limited to the use of these devices for communication and access to the Internet. For example, by installing just a small number of apps, an ordinary smartphone may be modified to fulfil the functions of medical devices such as heart monitoring or body analysis (Lippman, 2013). While regulatory guidelines and quality control for apps are still lagging behind (Buijink, Visser, & Marshall, 2013; Pandey, Hasan, Dubey, & Sarangi, 2013), this type of technology is clearly going to play an increasingly important role in healthcare (Gravenhorst et al., 2015; Mosa, Yoo, & Sheets, 2012).

In behavioral healthcare, apps are equally starting to become vehicles to improved service delivery, such as by providing clients with access to information and resources about specific health conditions or by enabling clients to track and graph the development of their behaviors, emotions, and symptoms (Luxton, McCann, Bush, Mishkind, & Reger, 2011; Şahin & Yan, 2013). Popular health-promoting apps allow users to monitor their nutritional and calorie intake or regulate their physical activities (Bert, Giacometti, Gualano, & Siliquini, 2014). During the last few years, touchscreen mobile device apps are also increasingly used to support people with developmental disabilities, both in everyday-life situations (Stephenson & Limbrick, 2015) and specifically to use in teaching programs (Kagohara et al., 2013). The wide-spread adoption of smartphone and tablet devices for augmentative and alternative communication (AAC) has been described as a potential paradigm shift toward a new kind of consumer-oriented delivery model (Shane, Laubscher, Schlosser, Flynn, Sorce, & Abramson, 2012).

The present scoping study (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010) outlines the purposes for which apps are used in studies involving individuals with ASD. This method is suitable when the goal is to map out conceptual and procedural boundaries in newly emerging fields (Davis, Drey, & Gould, 2009), in this case the rapidly expanding area of app use for healthcare. Previous related reviews of the research literature (Kagohara et al., 2013; Stephenson & Limbrick, 2015) focused on touchscreen mobile devices and not specifically on apps, or limited their focus to the use of touchscreen devices in teaching programs only (Kagohara et al., 2013). Additionally, these reviews considered people with developmental disabilities in general, while individuals with ASD have unique characteristics that may also affect the way smartphones and tablets are used. Lastly, stakeholder consultation was sought as a final step in the scoping study (Arksey & O'Malley, 2005; Levac et al., 2010) to provide a gauge of how representative the present findings may be of the actual use of apps by and with individuals with ASD. This has the advantage of being able to provide an exploratory link between the academic literature and actual experiences of individuals in the field.

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